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Complete Summary

GUIDELINE TITLE

ACC/AHA 2002 guideline update for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for the Management of Patients With Chronic Stable Angina).

BIBLIOGRAPHIC SOURCE(S)

American College of Cardiology Foundation, American Heart Association. ACC/AHA 2002 guideline update for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to update the 1999 guidelines). Bethesda (MD): American College of Cardiology Foundation; 2002. 127 p. [1052 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Gibbons RJ, Chatterjee K, Daley J, Douglas JS, Fihn SD, Gardin JM, Grunwald MA, Levy D, Lytle BW, O'Rourke RA, Schafer WP, Williams SV, Ritchie JL, Cheitlin MD, Eagle KA, Gardner TJ, Garson A Jr, Russell RO, Ryan TJ, Smith SC Jr. ACC/AHA/ACP-ASIM guidelines for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Patients With Chronic Stable). J Am Coll Cardiol 1999 Jun;33(7):2092-197.

COMPLETE SUMMARY CONTENT

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SCOPE

DISEASE/CONDITION(S)

Ischemic heart disease, chronic stable angina

GUIDELINE CATEGORY

Diagnosis
Evaluation
Risk Assessment
Treatment

CLINICAL SPECIALTY

Cardiology
Family Practice
Internal Medicine

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To assist physicians in clinical decision making by describing a range of generally acceptable approaches for the diagnosis and management of chronic stable angina

TARGET POPULATION

- Adult patients with stable chest pain syndromes and known or suspected ischemic heart disease. Patients who have "ischemic equivalents," such as dyspnea or arm pain with exertion, are included.
- Patients with nonanginal chest pain are included if there is sufficient suspicion of heart disease to warrant cardiac evaluation.
- Patients with recent unstable angina that was satisfactorily treated by medical therapy and who then present with a recurrence of symptoms with a stable pattern are included.
- Patients with myocardial infarction (MI) who subsequently present with stable chest pain symptoms more than 30 days after the initial event are included.

Excluded from this guideline are:

- Pediatric patients
- Patients with chest pain syndromes following cardiac transplantation
- Patients with chest pain symptoms early (within six months) after revascularization by either percutaneous techniques or coronary artery bypass grafting (CABG)
- Patients with acute ischemic syndromes
- Patients with nonanginal chest pain whose evaluation has demonstrated that ischemic heart disease is unlikely and their chest pain is a result of noncardiac causes
- Patients with high- and moderate-risk unstable angina

INTERVENTIONS AND PRACTICES CONSIDERED

Patient Evaluation

1. Patient history
2. Focused physical examination
3. Directed risk-factor assessment
4. Estimation of the probability of significant coronary artery disease (CAD) (i.e., low, intermediate, or high)

Laboratory Evaluation

1. Hemoglobin
2. Fasting glucose
3. Fasting lipid panel, including total cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, and calculated low-density lipoprotein (LDL) cholesterol

Noninvasive Measures

1. Resting electrocardiogram (ECG); exercise ECG without imaging
2. Chest x-ray
3. Electron-beam computed tomography (EBCT)
4. Resting echocardiography; exercise echocardiography; dobutamine echocardiography
5. Exercise myocardial perfusion imaging
6. Adenosine or dipyridamole (stress) myocardial perfusion imaging
7. Radionuclide angiography

Invasive Measures

1. Coronary angiography
2. Percutaneous coronary intervention (PCI)
3. Catheter-based techniques, such as stents, atherectomy, and laser therapy
4. Coronary artery bypass graft (CABG) surgery

Pharmacotherapy

1. Antiplatelet agents (aspirin, ticlopidine, clopidogrel)
2. Antithrombotic agents (warfarin)
3. Lipid-lowering agents (3-hydroxy-3-methylglutaryl coenzyme A [HMG-CoA] reductase inhibitor [statin])
4. Angiotensin-converting enzyme (ACE) inhibitors
5. Anti-anginal and anti-ischemic therapy (consisting of beta-blocking agents, calcium antagonists, and nitroglycerin and nitrates)

Alternative Therapies

1. Surgical laser transmyocardial revascularization (TMR)
2. Enhanced external counterpulsation
3. Spinal cord stimulation

Risk Factor Modification

1. Patient education
2. Treatment of hypertension
3. Smoking cessation therapy
4. Management of diabetes
5. Comprehensive cardiac rehabilitation program, including exercise
6. Low-density lipoprotein-lowering therapy
7. Weight reduction
8. Folate therapy
9. Identification and treatment of clinical depression
10. Stress reduction intervention

MAJOR OUTCOMES CONSIDERED

- Morbidity and mortality associated with ischemic heart disease
- Quality of life
- Diagnostic characteristics and test performance (sensitivity, specificity, predictive value of an abnormal test, predictive accuracy) of the exercise test and stress imaging techniques

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The committee reviewed and compiled published reports (excluding abstracts) through a series of computerized literature searches of the English language research literature since 1975 and a manual search of selected final articles. Methodological support was provided by the University of California, San Francisco-Stanford, Evidence-based Practice Center.

For exercise testing, the methodology is described in the "ACC/AHA Guidelines for Exercise Testing."

For stress imaging techniques, the guideline "ACC/AHA Guidelines for Clinical Use of Cardiac Radionuclide Imaging," published in 1995, was updated in the discussion of this guideline to reflect more recent publications.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Level of Evidence A: Data were derived from multiple randomized clinical trials involving large numbers of patients

Level of Evidence B: Data were derived from a limited number of randomized trials involving small numbers of patients, careful analyses of nonrandomized studies, or observational registries

Level of Evidence C: Consensus opinion of experts

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Methodological support was provided by the University of California, San Francisco-Stanford, Evidence-based Practice Center.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Experts in the subject under consideration are selected from the American College of Cardiology and the American Heart Association to examine subject-specific data and write guidelines. The process includes additional representatives from other medical specialty groups when appropriate. Writing groups are specifically charged to perform a formal literature review, weigh the strength of evidence for or against a particular treatment or procedure, and include estimates of expected health outcomes where data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that might influence the choice of particular tests or therapies are considered as well as frequency of follow-up and cost-effectiveness.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Class I: Conditions for which there is evidence for and/or general agreement that the procedure or treatment is useful and effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/ efficacy of a procedure or treatment.

Class IIa: The weight of evidence or opinion is in favor of the procedure or treatment.

Class IIb: Usefulness/efficacy is less well established by evidence or opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure or treatment is not useful/effective and in some cases may be harmful.

COST ANALYSIS

- The exercise electrocardiogram (ECG) is the least costly diagnostic test, with the cost of stress echocardiography being at least two-fold higher, stress single-photon mission computed tomography (SPECT) myocardial imaging at least five-fold higher, and coronary angiography 20-fold higher. A lower cost of the treadmill exercise test alone does not necessarily result in a lower overall cost of patient care, however, because the cost of additional testing and intervention may be higher because the exercise test is less accurate. Treadmill exercise tests are performed frequently but somewhat less often than the most frequent imaging procedure, which is stress SPECT myocardial perfusion imaging. An estimated 72% of the treadmill exercise tests charged to Medicare in 1998 were performed as office procedures, and 27% of these charges were submitted by noncardiologists.

- In this era of managed care, cost-effectiveness considerations have come into sharper focus in medical decision making. Commonly used measures of cost-effectiveness include the change in quality-adjusted life-years (QALY) per dollar of cost. This cost per QALY ratio is importantly affected by the pretest likelihood of coronary artery disease (CAD), test accuracy, and the cost and complication rates of the test. Patterson and Eisner used an assumption for detection of significant CAD of 75% sensitivity and 90% specificity for stress echocardiography and 84% sensitivity and 87% specificity for SPECT perfusion imaging. They found that the cost per QALY ratio was 8% to 12% higher for stress echocardiography than for SPECT thallium imaging. However, Marwick has argued that if Medicare reimbursement rates had been substituted for costs quoted by the authors and sensitivity/specificity data adjusted to 80% and 85%, respectively, for stress echocardiography, and 70% and 90%, respectively, for SPECT thallium imaging, the cost per QALY ratios would have decreased for both tests. Marwick also argued that the cost per QALY ratio would have been slightly lower for stress echocardiography (compared with stress perfusion imaging) at coronary disease probability rates of 20% to 30% and slightly higher for stress echocardiography at probability rates of 40% to 80%.

  A subsequent decision and cost-effectiveness analysis used published data (uncorrected for referral bias) to compare exercise electrocardiography, exercise thallium perfusion imaging, exercise echocardiography, and coronary angiography for the diagnosis of suspected CAD in a 55- year-old woman. Coronary angiography was most cost-effective in a woman of this age with definite angina, whereas exercise echocardiography was most cost-effective in the presence of atypical angina or nonanginal chest pain.

  A summary of comparative advantages of stress myocardial perfusion imaging and stress echocardiography is provided in Table 18 of the original guideline.

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

This document was reviewed by two outside reviewers nominated by the American College of Cardiology (ACC), two outside reviewers nominated by the American Heart Association (AHA), and two outside reviewers nominated by the American College of Physicians-American Society of Internal Medicine (ACP-ASIM).

The guideline was reviewed and approved by the governing bodies of the ACC, the AHA, and the Clinical Efficacy Assessment Subcommittee of the ACP-ASIM.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

The final recommendations for indications for a diagnostic procedure, particular therapy, or an intervention summarize both the evidence and expert opinion and are expressed in the American College of Cardiology (ACC)/American Heart Association (AHA) format as follows:

Class I: Conditions for which there is evidence or general agreement that a given procedure or treatment is useful and effective.

Class II: Conditions for which there is conflicting evidence or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful.

The weight of the evidence supporting a recommendation was ranked high (A) if the data were derived from multiple randomized clinical trials involving large numbers of patients and intermediate (B) if the data were derived from a limited number of randomized trials involving small numbers of patients, careful analyses of nonrandomized studies, or observational registries. A low rank (C) was given when expert consensus was the primary basis for the recommendation.

Diagnosis

History and Physical

Class I

In patients presenting with chest pain, a detailed symptom history, focused physical examination, and directed risk-factor assessment should be performed. With this information, the clinician should estimate the probability of significant coronary artery disease (CAD) (i.e., low, intermediate, or high). (Level of Evidence: B)

Associated Conditions -- Initial Laboratory Tests for Diagnosis

Class I

1. Hemoglobin. (Level of Evidence: C)
2. Fasting glucose. (Level of Evidence: C)
3. Fasting lipid panel, including total cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, and calculated low-density lipoprotein (LDL) cholesterol. (Level of Evidence: C)

Noninvasive Testing -- Electrocardiography (ECG)/Chest X-ray

Electrocardiography, Chest X-Ray, or Electron-Beam Computed Tomography in the Diagnosis of Chronic Stable Angina

Class I

1. Rest ECG in patients without an obvious noncardiac cause of chest pain. (Level of Evidence: B)
2. Rest ECG during an episode of chest pain. (Level of Evidence: B)
3. Chest X-ray in patients with signs or symptoms of congestive heart failure (CHF), valvular heart disease, pericardial disease, or aortic dissection/aneurysm. (Level of Evidence: B)

Class IIa

Chest X-ray in patients with signs or symptoms of pulmonary disease. (Level of Evidence: B)

Class IIb

1. Chest X-ray in other patients. (Level of Evidence: C)
2. Electron-beam computed tomography. (Level of Evidence: B)

Noninvasive Testing -- Exercise ECG for Diagnosis

Diagnosis of Obstructive Coronary Artery Disease (CAD) With Exercise ECG Testing Without an Imaging Modality

Class I

Patients with an intermediate pretest probability of coronary artery disease (CAD) based on age, gender, and symptoms, including those with complete right bundle-branch block or less than 1 mm of rest ST depression at rest (exceptions are listed below in classes II and III). (Level of Evidence: B)

Class IIa

Patients with suspected vasospastic angina. (Level of Evidence: C)

Class IIb

1. Patients with a high pretest probability of CAD by age, gender, and symptoms. (Level of Evidence: B)
2. Patients with a low pretest probability of CAD by age, gender, and symptoms. (Level of Evidence: B)
3. Patients taking digoxin whose ECG has less than 1 mm of baseline ST-segment depression. (Level of Evidence: B)
4. Patients with ECG criteria for left ventricular hypertrophy (LVH) and less than 1 mm of baseline ST-segment depression. (Level of Evidence: B)

Class III

1. Patients with the following baseline ECG abnormalities:
   a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
   b. Electronically paced ventricular rhythm. (Level of Evidence: B)
   c. More than 1 mm of ST depression at rest. (Level of Evidence: B)
   d. Complete left bundle-branch block. (Level of Evidence: B)
2. Patients with an established diagnosis of CAD owing to prior myocardial infarction (MI) or coronary angiography; however, testing can assess functional capacity and prognosis, as discussed in section III. (Level of Evidence: B)

Diagnosis of Obstructive CAD With Exercise ECG Testing Without an Imaging Modality in Asymptomatic Patients

Class IIb

Asymptomatic patients with possible myocardial ischemia on ambulatory ECG monitoring or with severe coronary calcification on electron-beam computed tomography (EBCT) (exceptions based on the rest ECG are the same as those listed above under Class III for symptomatic patients). (Level of Evidence: C)

Class III (These recommendations are identical to those for symptomatic patients.)

1. Patients with the following baseline ECG abnormalities.
   a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
   b. Electronically paced ventricular rhythm. (Level of Evidence: B)
   c. More than 1 mm of ST depression at rest. (Level of Evidence: B)
   d. Complete left bundle-branch block. (Level of Evidence: B)
2. Patients with an established diagnosis of CAD owing to prior MI or coronary angiography; however, testing can assess functional capacity and prognosis, as discussed in Section III of the guideline document (Risk Stratification). (Level of Evidence: B)

Noninvasive Testing -- Echocardiography (Resting)

Echocardiography for Diagnosis of Cause of Chest Pain in Patients with Suspected Chronic Stable Angina Pectoris

Class I

1. Patients with a systolic murmur suggestive of aortic stenosis and/or hypertrophic cardiomyopathy. (Level of Evidence: C)
2. Evaluation of extent (severity) of ischemia (e.g., left ventricular [LV] segmental wall-motion abnormality) when the echocardiogram can be obtained during pain or within 30 minutes after its abatement. (Level of Evidence: C)

Class IIb

Patients with a click or murmur to diagnose mitral valve prolapse. (Level of Evidence: C)

Class III

Patients with a normal ECG, no history of myocardial infarction (MI), and no signs or symptoms suggestive of heart failure, valvular heart disease, or hypertrophic cardiomyopathy. (Level of Evidence: C)

Noninvasive Testing -- Stress Imaging Studies: Echocardiographic and Nuclear

Cardiac Stress Imaging as the Initial Test for Diagnosis in Patients With Chronic Stable Angina Who Are Able to Exercise

Class I

1. Exercise myocardial perfusion imaging or exercise echocardiography in patients with an intermediate pretest probability of CAD who have one of the following baseline ECG abnormalities:
    a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
    b. More than 1 mm of ST depression at rest. (Level of Evidence: B)
2. Exercise myocardial perfusion imaging or exercise echocardiography in patients with prior revascularization (either percutaneous coronary intervention [PCI] or coronary artery bypass graft [CABG]). (Level of Evidence: B)
3. Adenosine or dipyridamole myocardial perfusion imaging in patients with an intermediate pretest probability of CAD and one of the following baseline ECG abnormalities:
    a. Electronically paced ventricular rhythm. (Level of Evidence: C)
    b. Left bundle-branch block. (Level of Evidence: B)

Class IIb

1. Exercise myocardial perfusion imaging or exercise echocardiography in patients with a low or high probability of CAD who have one of the following baseline ECG abnormalities:
   a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
   b. More than 1 mm of ST depression. (Level of Evidence: B)
2. Adenosine or dipyridamole myocardial perfusion imaging in patients with a low or high probability of CAD and one of the following baseline ECG abnormalities:
   a. Electronically paced ventricular rhythm. (Level of Evidence: C)
   b. Left bundle-branch block. (Level of Evidence: B)
3. Exercise myocardial perfusion imaging or exercise echocardiography in patients with an intermediate probability of CAD who have one of the following:
   a. Digoxin use with less than 1 mm ST depression on the baseline ECG. (Level of Evidence: B)
   b. LV hypertrophy with less than 1 mm ST depression on the baseline ECG. (Level of Evidence: B)
4. Exercise myocardial perfusion imaging, exercise echocardiography, adenosine or dipyridamole myocardial perfusion imaging, or dobutamine echocardiography as the initial stress test in a patient with a normal rest ECG who is not taking digoxin. (Level of Evidence: B)
5. Exercise or dobutamine echocardiography in patients with left bundle-branch block. (Level of Evidence: C)

Cardiac Stress Imaging as the Initial Test for Diagnosis in Patients With Chronic Stable Angina Who Are Unable to Exercise

Class I

1. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in patients with an intermediate pretest probability of CAD. (Level of Evidence: B)
2. Adenosine or dipyridamole stress myocardial perfusion imaging or dobutamine echocardiography in patients with prior revascularization (either PCI or CABG). (Level of Evidence: B)

Class IIb

1. Adenosine or dipyridamole stress myocardial perfusion imaging or dobutamine echocardiography in patients with a low or high probability of CAD in the absence of electronically paced ventricular rhythm or left bundle-branch block. (Level of Evidence: B)
2. Adenosine or dipyridamole myocardial perfusion imaging in patients with a low or high probability of CAD and one of the following baseline ECG abnormalities:
   a. Electronically paced ventricular rhythm. (Level of Evidence: C)
   b. Left bundle-branch block. (Level of Evidence: B)
3. Dobutamine echocardiography in patients with left bundle-branch block. (Level of Evidence: C)

Cardiac Stress Imaging as the Initial Test for Diagnosis in Asymptomatic Patients

Class IIb

1. Exercise perfusion imaging or exercise echocardiography in asymptomatic patients with severe coronary calcification on electron-beam computed tomography (EBCT) who are able to exercise and have one of the following baseline ECG abnormalities:
    a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: C)
    b. More than 1 mm of ST depression at rest. (Level of Evidence: C)
2. Adenosine or dipyridamole myocardial perfusion imaging in asymptomatic patients with severe coronary calcification on EBCT but with one of the following baseline ECG abnormalities:
    a. Electronically paced ventricular rhythm. (Level of Evidence: C)
    b. Left bundle-branch block. (Level of Evidence: C)
3. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in patients with possible myocardial ischemia on ambulatory ECG monitoring or with severe coronary calcification on EBCT who are unable to exercise. (Level of Evidence: C)

Class III

1. Exercise or dobutamine echocardiography in asymptomatic patients with left bundle-branch block. (Level of Evidence: C)
2. Exercise myocardial perfusion imaging, exercise echocardiography, adenosine or dipyridamole myocardial perfusion imaging, or dobutamine echocardiography as the initial stress test in an asymptomatic patient with a normal rest ECG who is not taking digoxin. (Level of Evidence: C)
3. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in asymptomatic patients who are able to exercise and do not have left bundle-branch block or electronically paced ventricular rhythm. (Level of Evidence: C)

Cardiac Stress Imaging After Exercise ECG Testing for Diagnosis in Asymptomatic Patients

Class IIb

1. Exercise myocardial perfusion imaging or exercise echocardiography in asymptomatic patients with an intermediate-risk or high-risk Duke treadmill score on exercise ECG testing. (Level of Evidence: C)
2. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in asymptomatic patients with a previously inadequate exercise ECG. (Level of Evidence: C)

Class III

Exercise myocardial perfusion imaging, exercise echocardiography, adenosine or dipyridamole myocardial perfusion imaging, or dobutamine echocardiography in

asymptomatic patients with a low-risk Duke treadmill score on exercise ECG testing. (Level of Evidence: C)

Invasive Testing: Value of Coronary Angiography

Coronary Angiography to Establish a Diagnosis in Patients with Suspected Angina, Including Those with Known CAD Who Have a Significant Change in Anginal Symptoms

Class I

Patients with known or possible angina pectoris who have survived sudden cardiac death. (Level of Evidence: B)

Class IIa

1. Patients with an uncertain diagnosis after noninvasive testing in whom the benefit of a more certain diagnosis outweighs the risk and cost of coronary angiography. (Level of Evidence: C)
2. Patients who cannot undergo noninvasive testing due to disability, illness, or morbid obesity. (Level of Evidence: C)
3. Patients with an occupational requirement for a definitive diagnosis. (Level of Evidence: C)
4. Patients who by virtue of young age at onset of symptoms, noninvasive imaging, or other clinical parameters are suspected of having a nonatherosclerotic cause for myocardial ischemia (coronary artery anomaly, Kawasaki disease, primary coronary artery dissection, radiation-induced vasculopathy). (Level of Evidence: C)
5. Patients in whom coronary artery spasm is suspected and provocative testing may be necessary. (Level of Evidence: C)
6. Patients with a high pretest probability of left main or three-vessel CAD. (Level of Evidence: C)

Class IIb

1. Patients with recurrent hospitalization for chest pain in whom a definite diagnosis is judged necessary. (Level of Evidence: C)
2. Patients with an overriding desire for a definitive diagnosis and a greater-than-low probability of CAD. (Level of Evidence: C)

Class III

1. Patients with significant comorbidity in whom the risk of coronary arteriography outweighs the benefit of the procedure. (Level of Evidence: C)
2. Patients with an overriding personal desire for a definitive diagnosis and a low probability of CAD. (Level of Evidence: C)

Risk Stratification

Noninvasive Testing -- Resting Left Ventricular (LV) Function (Echocardiographic/Radionuclide Imaging)

Measurement of Rest LV Function by Echocardiography or Radionuclide Angiography in Patients with Chronic Stable Angina

Class I

1. Echocardiography or radionuclide angiography (RNA) in patients with a history of prior MI, pathological Q waves, or symptoms or signs suggestive of heart failure to assess LV function. (Level of Evidence: B)
2. Echocardiography in patients with a systolic murmur that suggests mitral regurgitation to assess its severity and etiology. (Level of Evidence: C)
3. Echocardiography or RNA in patients with complex ventricular arrhythmias to assess LV function. (Level of Evidence: B)

Class III

1. Routine periodic reassessment of stable patients for whom no new change in therapy is contemplated. (Level of Evidence: C)
2. Patients with a normal ECG, no history of MI, and no symptoms or signs suggestive of congestive heart failure (CHF). (Level of Evidence: B)

Noninvasive Testing -- Exercise Testing for Risk Stratification and Prognosis

Risk Assessment and Prognosis in Patients With an Intermediate or High Probability of CAD

Class I

1. Patients undergoing initial evaluation. (Exceptions are listed below in classes IIb and III.) (Level of Evidence: B)
2. Patients after a significant change in cardiac symptoms. (Level of Evidence: C)

Class IIb

1. Patients with the following ECG abnormalities:
    a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
    b. Electronically paced ventricular rhythm. (Level of Evidence: B)
    c. More than 1 mm of ST depression at rest. (Level of Evidence: B)
    d. Complete left bundle-branch block. (Level of Evidence: B)
2. Patients who have undergone cardiac catheterization to identify ischemia in the distribution of a coronary lesion of borderline severity. (Level of Evidence: C)
3. Postrevascularization patients who have a significant change in anginal pattern suggestive of ischemia. (Level of Evidence: C)

Class III

Patients with severe comorbidity likely to limit life expectancy or prevent revascularization. (Level of Evidence: C)

Exercise Testing in Patients With Chest Pain 6 Months or More After Revascularization

Class IIb

Patients with a significant change in anginal pattern suggestive of ischemia. (Level of Evidence: B)

Exercise Testing for Risk Assessment and Prognosis in Asymptomatic Patients

Class IIb

Asymptomatic patients with possible myocardial ischemia on ambulatory ECG monitoring or with severe coronary calcification on electron-beam computed tomography (EBCT) (exceptions are listed below in III). (Level of Evidence: C)

Class III

1. Asymptomatic patients with possible myocardial ischemia on ambulatory ECG monitoring or with severe coronary calcification on EBCT, but with the following baseline ECG abnormalities:
    a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: B)
    b. Electronically paced ventricular rhythm. (Level of Evidence: B)
    c. More than 1 mm of ST depression at rest. (Level of Evidence: B)
    d. Complete left bundle-branch block. (Level of Evidence: B)

Noninvasive Testing -- Stress Imaging Studies (Radionuclide and Echocardiography)

Cardiac Stress Imaging as the Initial Test for Risk Stratification of Patients With Chronic Stable Angina Who Are Able to Exercise

Class I

1. Exercise myocardial perfusion imaging or exercise echocardiography to identify the extent, severity, and location of ischemia in patients who do not have left bundle-branch block or an electronically paced ventricular rhythm and have either an abnormal rest ECG or are using digoxin. (Level of Evidence: B)
2. Dipyridamole or adenosine myocardial perfusion imaging in patients with left bundle-branch block or electronically paced ventricular rhythm. (Level of Evidence: B)
3. Exercise myocardial perfusion imaging or exercise echocardiography to assess the functional significance of coronary lesions (if not already known) in planning percutaneous coronary intervention (PCI). (Level of Evidence: B)

Class IIb

1. Exercise or dobutamine echocardiography in patients with left bundle-branch block. (Level of Evidence: C)
2. Exercise, dipyridamole, adenosine myocardial perfusion imaging, or exercise or dobutamine echocardiography as the initial test in patients who have a normal rest ECG and are not taking digoxin. (Level of Evidence: B)

Class III

1. Exercise myocardial perfusion imaging in patients with left bundle-branch block. (Level of Evidence: C)
2. Exercise, dipyridamole, adenosine myocardial perfusion imaging, or exercise or dobutamine echocardiography in patients with severe comorbidity likely to limit life expectation or prevent revascularization. (Level of Evidence: C)

Cardiac Stress Imaging as the Initial Test for Risk Stratification of Patients With Chronic Stable Angina Who Are Unable to Exercise

Class I

1. Dipyridamole or adenosine myocardial perfusion imaging or dobutamine echocardiography to identify the extent, severity, and location of ischemia in patients who do not have left bundle-branch block or electronically paced ventricular rhythm. (Level of Evidence: B)
2. Dipyridamole or adenosine myocardial perfusion imaging in patients with left bundle-branch block or electronically paced ventricular rhythm. (Level of Evidence: B)
3. Dipyridamole or adenosine myocardial perfusion imaging or dobutamine echocardiography to assess the functional significance of coronary lesions (if not already known) in planning PCI. (Level of Evidence: B)

Class IIb

Dobutamine echocardiography in patients with left bundle-branch block. (Level of Evidence: C)

Class III

Dipyridamole or adenosine myocardial perfusion imaging or dobutamine echocardiography in patients with severe comorbidity likely to limit life expectation or prevent revascularization. (Level of Evidence: C)

Asymptomatic Patients

Cardiac Stress Imaging as the Initial Test for Risk Stratification in Asymptomatic Patients

Class IIb

1. Exercise perfusion imaging or exercise echocardiography in asymptomatic patients with severe coronary calcification on EBCT who are able to exercise and have one of the following baseline ECG abnormalities:

a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: C)
b. More than 1 mm of ST depression at rest. (Level of Evidence: C)
2. Adenosine or dipyridamole myocardial perfusion imaging in patients with severe coronary calcification on EBCT, but with one of the following baseline ECG abnormalities:
a. Electronically paced ventricular rhythm. (Level of Evidence: C)
b. Left bundle-branch block. (Level of Evidence: C)
3. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in patients with possible myocardial ischemia on ambulatory ECG monitoring or with severe coronary calcification on EBCT who are unable to exercise. (Level of Evidence: C)

Class III

1. Exercise or dobutamine echocardiography in asymptomatic patients with left bundle-branch block. (Level of Evidence: C)
2. Exercise myocardial perfusion imaging, exercise echocardiography, adenosine or dipyridamole myocardial perfusion imaging, or dobutamine echocardiography as the initial stress test in an asymptomatic patient with a normal rest ECG who is not taking digoxin. (Level of Evidence: C)
3. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in asymptomatic patients who are able to exercise. (Level of Evidence: C)

Cardiac Stress Imaging After Exercise ECG Testing for Risk Stratification in Asymptomatic Patients

Class IIb

1. Exercise myocardial perfusion imaging or exercise echocardiography in asymptomatic patients with an intermediate-risk or high-risk Duke treadmill score on exercise ECG testing. (Level of Evidence: C)
2. Adenosine or dipyridamole myocardial perfusion imaging or dobutamine echocardiography in asymptomatic patients with a previously inadequate exercise ECG. (Level of Evidence: C)

Class III

Exercise myocardial perfusion imaging, exercise echocardiography, adenosine or dipyridamole myocardial perfusion imaging, or dobutamine echocardiography in asymptomatic patients with a low-risk Duke treadmill score on exercise ECG testing. (Level of Evidence: C)

Invasive Testing -- Coronary Angiography

Coronary Angiography for Risk Stratification in Patients with Chronic Stable Angina

Class I

1. Patients with disabling (Canadian Cardiovascular Society [CCS] classes III and IV) chronic stable angina despite medical therapy. (Level of Evidence: B)
2. Patients with high-risk criteria on noninvasive testing (see Table 23 in the original guideline document) regardless of anginal severity. (Level of Evidence: B)
3. Patients with angina who have survived sudden cardiac death or serious ventricular arrhythmia. (Level of Evidence: B)
4. Patients with angina and symptoms and signs of CHF. (Level of Evidence: C)
5. Patients with clinical characteristics that indicate a high likelihood of severe CAD. (Level of Evidence: C)

Class IIa

1. Patients with significant LV dysfunction (ejection fraction less than 45%), CCS class I or II angina, and demonstrable ischemia but less than high-risk criteria on noninvasive testing. (Level of Evidence: C)
2. Patients with inadequate prognostic information after noninvasive testing. (Level of Evidence: C)

Class IIb

1. Patients with CCS class I or II angina, preserved LV function (ejection fraction greater than 45%), and less than high-risk criteria on noninvasive testing. (Level of Evidence: C)
2. Patients with CCS class III or IV angina, which with medical therapy improves to class I or II. (Level of Evidence: C)
3. Patients with CCS class I or II angina but intolerance (unacceptable side effects) to adequate medical therapy. (Level of Evidence: C)

Class III

1. Patients with CCS class I or II angina who respond to medical therapy and have no evidence of ischemia on noninvasive testing. (Level of Evidence: C)
2. Patients who prefer to avoid revascularization. (Level of Evidence: C)

Coronary Angiography for Risk Stratification in Asymptomatic Patients

Class IIa

Patients with high-risk criteria suggesting ischemia on noninvasive testing (see Table 23, items 2-9 in the original guideline document). (Level of Evidence: C)

Class IIb

1. Patients with inadequate prognostic information after noninvasive testing. (Level of Evidence: C)
2. Patients with clinical characteristics that indicate a high likelihood of severe CAD. (Level of Evidence: C)

Class III

Patients who prefer to avoid revascularization. (Level of Evidence: C)

Treatment

Pharmacologic Therapy

Pharmacotherapy to Prevent MI and Death and to Reduce Symptoms

Class I

1. Aspirin in the absence of contraindications. (Level of Evidence: A)
2. Beta-blockers as initial therapy in the absence of contraindications in patients with prior myocardial infarction (MI) (Level of Evidence: A) or without prior MI. (Level of Evidence: B)
3. Angiotensin-converting enzyme (ACE) inhibitor in all patients with CAD* who also have diabetes and/or LV systolic dysfunction. (Level of Evidence: A)
4. Low-density lipoprotein (LDL)-lowering therapy in patients with documented or suspected CAD and LDL cholesterol greater than 130 mg per dl, with a target LDL of less than 100 mg per dl. (Level of Evidence: A)
5. Sublingual nitroglycerin or nitroglycerin spray for the immediate relief of angina. (Level of Evidence: B)
6. Calcium antagonists** or long-acting nitrates as initial therapy for reduction of symptoms when beta-blockers are contraindicated. (Level of Evidence: B)
7. Calcium antagonists** or long-acting nitrates in combination with beta-blockers when initial treatment with beta-blockers is not successful. (Level of Evidence: B)
8. Calcium antagonists** and long-acting nitrates as a substitute for beta-blockers if initial treatment with beta-blockers leads to unacceptable side effects. (Level of Evidence: C)

*Significant CAD by angiography or previous MI.

**Short-acting dihydropyridine calcium antagonists should be avoided.

Class IIa

1. Clopidogrel when aspirin is absolutely contraindicated. (Level of Evidence: B)
2. Long-acting nondihydropyridine calcium antagonists** instead of beta-blockers as initial therapy. (Level of Evidence: B)
3. In patients with documented or suspected CAD and LDL cholesterol 100 to 129 mg per dl, several therapeutic options are available: (Level of Evidence: B)
    a. Lifestyle and/or drug therapies to lower LDL to less than 100 mg per dl.
    b. Weight reduction and increased physical activity in persons with the metabolic syndrome (see page 74 of the original guideline document).
    c. Institution of treatment of other lipid or nonlipid risk factors; consider use of nicotinic acid or fibric acid for elevated triglycerides or low HDL cholesterol.
4. Angiotensin-converting enzyme (ACE) inhibitor in patients with CAD or other vascular disease. (Level of Evidence: B)

**Short-acting dihydropyridine calcium antagonists should be avoided.

Class IIb

Low-intensity anticoagulation with warfarin in addition to aspirin. (Level of Evidence: B)

Class III

1. Dipyridamole. (Level of Evidence: B)
2. Chelation therapy. (Level of Evidence: B)

Pharmacotherapy to Prevent Myocardial Infarction (MI) and Death in Asymptomatic Patients

Class I

1. Aspirin in the absence of contraindication in patients with prior MI (Level of Evidence: A)
2. Beta-blockers as initial therapy in the absence of contraindications in patients with prior MI. (Level of Evidence: B)
3. Lipid-lowering therapy in patients with documented CAD and LDL cholesterol greater than 130 mg per dl, with a target LDL of less than 100 mg per dl. (Level of Evidence: A)
4. ACE inhibitor in patients with CAD who also have diabetes and/or systolic dysfunction. (Level of Evidence: A)

Class IIa

1. Aspirin in the absence of contraindications in patients without prior MI. (Level of Evidence: B)
2. Beta-blockers as initial therapy in the absence of contraindications in patients without prior MI. (Level of Evidence: C)
3. Lipid-lowering therapy in patients with documented CAD and LDL cholesterol of 100 to 129 mg per dl, with a target LDL of 100 mg per dl. (Level of Evidence: C)
4. Angiotensin-converting enzyme inhibitor in all patients with diabetes who do not have contraindications due to severe renal disease. (Level of Evidence: B)

Treatment of Risk Factors

Class I

1. Treatment of hypertension according to Joint National Conference VI guidelines. (Level of Evidence: A)
2. Smoking cessation therapy. (Level of Evidence: B)
3. Management of diabetes. (Level of Evidence: C)
4. Comprehensive cardiac rehabilitation program (including exercise). (Level of Evidence: B)

5. LDL-lowering therapy in patients with documented or suspected CAD and LDL cholesterol greater than or equal to 130 mg/dl, with a target LDL of less than 100 mg/dl. (Level of Evidence: A)
6. Weight reduction in obese patients in the presence of hypertension, hyperlipidemia, or diabetes mellitus. (Level of Evidence: C)

Class IIa

1. In patients with documented or suspected CAD and LDL cholesterol 100 to 129 mg/dL, several therapeutic options are available:
    a. Lifestyle and/or drug therapies to lower LDL to less than 100 mg per dl. (Level of Evidence: B)
    b. Weight reduction and increased physical activity in persons with the metabolic syndrome. (Level of Evidence: B)
    c. Institution of treatment of other lipid or nonlipid risk factors; consider use of nicotinic acid or fibric acid for elevated triglycerides or low high-density lipoprotein (HDL) cholesterol. (Level of Evidence: B)
2. Therapy to lower non-HDL cholesterol in patients with documented or suspected CAD and triglycerides of greater than 200 mg per dl, with a target non-HDL cholesterol of less than 130 mg per dl. (Level of Evidence: B)
3. Weight reduction in obese patients in the absence of hypertension, hyperlipidemia, or diabetes mellitus. (Level of Evidence: C)

Class IIb

1. Folate therapy in patients with elevated homocysteine levels. (Level of Evidence: C)
2. Identification and appropriate treatment of clinical depression to improve CAD outcomes. (Level of Evidence: C)
3. Intervention directed at psychosocial stress reduction. (Level of Evidence: C)

Class III

1. Initiation of hormone replacement therapy in post-menopausal women for the purpose of reducing cardiovascular risk. (Level of Evidence: A)
2. Vitamin C and E supplementation. (Level of Evidence: A)
3. Chelation therapy. (Level of Evidence: C)
4. Garlic. (Level of Evidence: C)
5. Acupuncture. (Level of Evidence: C)
6. Coenzyme Q. (Level of Evidence: C)

Revascularization for Chronic Stable Angina

Revascularization With PCI (or Other Catheter-Based Techniques) and CABG in Patients With Stable Angina

Class I

1. Coronary artery bypass grafting for patients with significant left main coronary disease. (Level of Evidence: A)

2. Coronary artery bypass grafting for patients with three-vessel disease. The survival benefit is greater in patients with abnormal LV function (ejection fraction less than 50%). (Level of Evidence: A)
3. Coronary artery bypass grafting for patients with two-vessel disease with significant proximal left anterior descending (LAD) CAD and either abnormal left ventricular (LV) function (ejection fraction less than 50%) or demonstrable ischemia on noninvasive testing. (Level of Evidence: A)
4. Percutaneous coronary intervention (PCI) for patients with two- or three-vessel disease with significant proximal LAD CAD, who have anatomy suitable for catheter-based therapy and normal LV function, and who do not have treated diabetes. (Level of Evidence: B)
5. Percutaneous coronary intervention or CABG for patients with one- or two-vessel CAD without significant proximal LAD CAD but with a large area of viable myocardium and high-risk criteria on noninvasive testing. (Level of Evidence: B)
6. Coronary artery bypass grafting for patients with one- or two-vessel CAD without significant proximal LAD CAD who have survived sudden cardiac death or sustained ventricular tachycardia. (Level of Evidence: C)
7. In patients with prior PCI, CABG or PCI for recurrent stenosis associated with a large area of viable myocardium or high-risk criteria on noninvasive testing. (Level of Evidence: C)
8. Percutaneous coronary intervention or CABG for patients who have not been successfully treated by medical therapy (see guideline text) and can undergo revascularization with acceptable risk. (Level of Evidence: B)

Class IIa

1. Repeat CABG for patients with multiple saphenous vein graft stenoses, especially when there is significant stenosis of a graft supplying the LAD. It may be appropriate to use PCI for focal saphenous vein graft lesions or multiple stenoses in poor candidates for reoperative surgery. (Level of Evidence: C)
2. Use of PCI or CABG for patients with one- or two-vessel CAD without significant proximal LAD disease but with a moderate area of viable myocardium and demonstrable ischemia on noninvasive testing. (Level of Evidence: B)
3. Use of PCI or CABG for patients with one-vessel disease with significant proximal LAD disease. (Level of Evidence: B)

Class IIb

1. Compared with CABG, PCI for patients with two- or three-vessel disease with significant proximal LAD CAD, who have anatomy suitable for catheter-based therapy, and who have treated diabetes or abnormal LV function. (Level of Evidence: B)
2. Use of PCI for patients with significant left main coronary disease who are not candidates for CABG. (Level of Evidence: C)
3. PCI for patients with one- or two-vessel CAD without significant proximal LAD CAD who have survived sudden cardiac death or sustained ventricular tachycardia. (Level of Evidence: C)

Class III

1. Use of PCI or CABG for patients with one- or two-vessel CAD without significant proximal LAD CAD, who have mild symptoms that are unlikely due to myocardial ischemia or have not received an adequate trial of medical therapy and
   a. Have only a small area of viable myocardium or
   b. Have no demonstrable ischemia on noninvasive testing. (Level of Evidence: C)
2. Use of PCI or CABG for patients with borderline coronary stenoses (50% to 60% diameter in locations other than the left main coronary artery) and no demonstrable ischemia on noninvasive testing. (Level of Evidence: C)
3. Use of PCI or CABG for patients with insignificant coronary stenosis (less than 50% diameter). (Level of Evidence: C)
4. Use of PCI in patients with significant left main coronary artery disease who are candidates for CABG. (Level of Evidence: B)

Alternative Therapies for Chronic Stable Angina in Patients Refractory to Medical Therapy Who Are Not Candidates for Percutaneous Intervention or Surgical Revascularization

Class IIa

Surgical laser transmyocardial revascularization. (Level of Evidence: A)

Class IIb

1. Enhanced external counterpulsation. (Level of Evidence: B)
2. Spinal cord stimulation. (Level of Evidence: B)

Revascularization with PCI and CABG in Asymptomatic Patients

Class I (These recommendations are identical to those for symptomatic patients.)

1. Coronary artery bypass grafting for patients with significant left main coronary disease. (Level of Evidence: B)
2. Coronary artery bypass grafting for patients with three-vessel disease. The survival benefit is greater in patients with abnormal LV function (ejection fraction less than 50%). (Level of Evidence: C)
3. Coronary artery bypass grafting for patients with two-vessel disease with significant proximal LAD CAD and either abnormal LV function (ejection fraction less than 50%) or demonstrable ischemia on noninvasive testing. (Level of Evidence: C)
4. Percutaneous coronary intervention for patients with two- or three-vessel disease with significant proximal LAD CAD who have anatomy suitable for catheter-based therapy and normal LV function and who do not have treated diabetes. (Level of Evidence: C)
5. Percutaneous coronary intervention or CABG for patients with one- or two-vessel CAD without significant proximal LAD CAD but with a large area of viable myocardium and high-risk criteria on noninvasive testing. (Level of Evidence: C)
6. Coronary artery bypass grafting for patients with one- or two-vessel CAD without significant proximal LAD CAD who have survived sudden cardiac death or sustained ventricular tachycardia. (Level of Evidence: C)

7. In patients with prior PCI, CABG or PCI for recurrent stenosis associated with a large area of viable myocardium or high-risk criteria on noninvasive testing. (Level of Evidence: C)

Class IIa (This recommendation is identical to the Class IIa recommendation for symptomatic patients.)

PCI or CABG for patients with one-vessel disease with significant proximal LAD CAD. (Level of Evidence: C)

Class IIb (Recommendations 1, 2, and 3 are identical to the recommendations for symptomatic patients. Recommendations 4 and 5 are identical to Class IIa recommendations for symptomatic patients.)

1. Compared with CABG, PCI for patients with 2- or 3-vessel disease with significant proximal LAD CAD who have anatomy suitable for catheter-based therapy and who have treated diabetes or abnormal LV function. (Level of Evidence: B)
2. Use of PCI for patients with significant left main coronary disease who are not candidates for CABG. (Level of Evidence: C)
3. Percutaneous coronary intervention for patients with one- or two-vessel CAD without significant proximal LAD CAD who have survived sudden cardiac death or sustained ventricular tachycardia. (Level of Evidence: C)
4. Repeat CABG for patients with multiple saphenous vein graft stenoses, with high-risk criteria on noninvasive testing, especially when there is significant stenosis of a graft supplying the LAD. Percutaneous coronary intervention may be appropriate for focal saphenous vein graft lesions or multiple stenoses in poor candidates for reoperative surgery. (Level of Evidence: C)
5. Percutaneous coronary intervention or CABG for patients with one- or two-vessel CAD without significant proximal LAD CAD but with a moderate area of viable myocardium and demonstrable ischemia on noninvasive testing. (Level of Evidence: C)

Class III (These recommendations are identical to the Class III recommendations for symptomatic patients.)

1. Use of PCI or CABG for patients with one- or two-vessel CAD without significant proximal LAD CAD and
   a. only a small area of viable myocardium or
   b. no demonstrable ischemia on noninvasive testing. (Level of Evidence: C)
2. Use of PCI or CABG for patients with borderline coronary stenoses (50% to 60% diameter in locations other than the left main coronary artery) and no demonstrable ischemia on noninvasive testing. (Level of Evidence: C)
3. Use of PCI or CABG for patients with insignificant coronary stenosis (less than 50% diameter). (Level of Evidence: C)
4. Use of PCI in patients with significant left main CAD who are candidates for CABG. (Level of Evidence: B)

Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

Echocardiography, Treadmill Exercise Testing, Stress Radionuclide Imaging, Stress Echocardiography Studies, and Coronary Angiography During Patient Follow-Up

Class I

1. Chest x-ray for patients with evidence of new or worsening CHF. (Level of Evidence: C)
2. Assessment of left ventricular (LV) ejection fraction and segmental wall motion by echocardiography or radionuclide imaging in patients with new or worsening CHF or evidence of intervening MI by history or ECG. (Level of Evidence: C)
3. Echocardiography for evidence of new or worsening valvular heart disease. (Level of Evidence: C)
4. Treadmill exercise test for patients without prior revascularization who have a significant change in clinical status, are able to exercise, and do not have any of the ECG abnormalities listed below in number 5. (Level of Evidence: C)
5. Stress radionuclide imaging or stress echocardiography procedures for patients without prior revascularization who have a significant change in clinical status and are unable to exercise or have one of the following ECG abnormalities:
    a. Pre-excitation (Wolff-Parkinson-White) syndrome. (Level of Evidence: C)
    b. Electronically paced ventricular rhythm. (Level of Evidence: C)
    c. More than 1 mm of rest ST depression. (Level of Evidence: C)
    d. Complete left bundle-branch block. (Level of Evidence: C)
6. Stress radionuclide imaging or stress echocardiography procedures for patients who have a significant change in clinical status and required a stress imaging procedure on their initial evaluation because of equivocal or intermediate-risk treadmill results. (Level of Evidence: C)
7. Stress radionuclide imaging or stress echocardiography procedures for patients with prior revascularization who have a significant change in clinical status. (Level of Evidence: C)
8. Coronary angiography in patients with marked limitation of ordinary activity (CCS class III) despite maximal medical therapy. (Level of Evidence: C)

Class IIb

Annual treadmill exercise testing in patients who have no change in clinical status, can exercise, have none of the ECG abnormalities listed in number 5 above, and have an estimated annual mortality of greater than 1%. (Level of Evidence: C)

Class III

1. Echocardiography or radionuclide imaging for assessment of LV ejection fraction and segmental wall motion in patients with a normal ECG, no history of MI, and no evidence of CHF. (Level of Evidence: C)
2. Repeat treadmill exercise testing in less than three years in patients who have no change in clinical status and an estimated annual mortality rate less than 1% on their initial evaluation, as demonstrated by one of the following:
    a. Low-risk Duke treadmill score (without imaging). (Level of Evidence: C)

b. Low-risk Duke treadmill score with negative imaging. (Level of Evidence: C)
c. Normal LV function and a normal coronary angiogram. (Level of Evidence: C)
d. Normal LV function and insignificant CAD. (Level of Evidence: C)

3. Stress imaging or echocardiography for patients who have no change in clinical status and a normal rest ECG, are not taking digoxin, are able to exercise, and did not require a stress imaging or echocardiographic procedure on their initial evaluation because of equivocal or intermediate-risk treadmill results. (Level of Evidence: C)

4. Repeat coronary angiography in patients with no change in clinical status, no change on repeat exercise testing or stress imaging, and insignificant CAD on initial evaluation. (Level of Evidence: C

CLINICAL ALGORITHM(S)

Algorithms are provided in the original guideline document for:

- Clinical Assessment
- Stress Testing/Angiography
- Treatment

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence (randomized clinical trials, nonrandomized studies, observational registries, or expert consensus) is identified and graded for each recommendation (see "Major Recommendations"). The recommendations were based primarily on the data published in the studies included in the evidence tables.

The primary evidence that exercise testing can be used to estimate prognosis and assist in management decisions consists of seven observational studies.

Published evidence of the efficacy of specific strategies for the follow-up of patients with chronic stable angina does not exist; therefore, the recommendations for follow-up are based on consensus of the committee.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Successful treatment of chronic stable angina may prevent myocardial infarction and death as well as reduce symptoms of angina and occurrence of ischemia thereby improving the quality of life.
- These guidelines may improve the effectiveness of care, optimize patient outcomes, and have a favorable impact on the overall cost of care by focusing resources on the most effective strategies. The need for practice guidelines is evident by the magnitude of the problem of chronic stable angina and is

further reinforced by the available information, which suggests considerable regional differences in the management of ischemic heart disease.

POTENTIAL HARMS

Exercise Testing

Myocardial infarction and death can be expected to occur at a rate of up to 1 per 2500 tests.

Pharmacologic Modalities Used in Stress Testing

- Dipyridamole and adenosine have frequent mild side effects, occurring in 50% and 80% of patients, respectively. Angina (18% to 42%), arrhythmia (< 2%), headache (5% to 23%), dizziness (5% to 21%), nausea (8% to 12%), and flushing (3%) are associated with dipyridamole. Adenosine causes chest pain (57%), headache (35%), flushing (25%), shortness of breath (15%), and first-degree atrioventricular (AV) block (18%). Most of the side effects are well tolerated. Severe side effects are rare, but both may cause severe bronchospasm in patients with asthma or chronic obstructive lung disease.
- Dobutamine noncardiac side effects include nausea (8%), anxiety (6%), headache (4%), and tremor (4%). Common arrhythmias include premature ventricular beats (15%), premature atrial beats (8%), and supraventricular tachycardia and nonsustained ventricular tachycardia (3% to 4%). Atypical chest pain (8%) and angina pectoris (20%) were also reported.

Pharmacotherapy

- Beta-blockers. Fatigue, inability to perform exercise, lethargy, insomnia, nightmares, worsening claudication and impotence are the most commonly reported side effects.
- Calcium antagonists. Hypotension, depression of cardiac function, and worsening heart failure may occur during long-term treatment. Peripheral edema and constipation are recognized side effects. Headache, flushing, dizziness and nonspecific central nervous system symptoms may also occur. Bradycardia, AV dissociation, AV block, and sinus node dysfunction may occur with heart rate-modulating calcium antagonists. Bepridil can induce polymorphic ventricular tachycardia associated with an increased QT interval.
- Nitrates and Nitroglycerin. Nitrate tolerance may develop with long-term use. The most common side effect during therapy is headache. Patients may develop hypotension and pre-syncope or syncope. Rarely, sublingual nitroglycerin administration can produce bradycardia and hypotension, probably due to activation of the Bezold-Jarisch reflex.

CONTRAINDICATIONS

CONTRAINDICATIONS

Exercise Testing

- Absolute contraindications: acute myocardial infarction within 2 days, cardiac arrhythmias causing symptoms or hemodynamic compromise, symptomatic and severe aortic stenosis, symptomatic heart failure, acute pulmonary embolus or pulmonary infarction, acute myocarditis or pericarditis, and acute aortic dissection.
- Relative contraindications: left main coronary stenosis, moderate aortic stenosis, electrolyte abnormalities, systolic hypertension greater than 200 mm Hg, diastolic pressure greater than 110 mm Hg, tachyarrhythmias or bradyarrhythmias, hypertrophic cardiomyopathy and other forms of outflow tract obstruction, mental or physical impairment leading to an inability to exercise adequately, and high-degree atrioventricular (AV) block.

Pharmacotherapy

Beta-blockers

- Absolute contraindications: severe bradycardia, pre-existing high degree of AV block, sick sinus syndrome, and severe, unstable left ventricular (LV) failure (mild congenital heart failure [CHF] may be an indication for beta-blockers).
- Relative contraindications: asthma and bronchospastic disease, severe depression, and peripheral vascular disease. Beta-blockers should be used cautiously in diabetic patients who require insulin.

Calcium Antagonists

Overt decompensated heart failure is a contraindication. Bradycardia, sinus node dysfunction, and AV nodal block are contraindications for the use of heart rate-modulating calcium antagonists. A long QT interval is a contraindication for the use of bepridil.

Nitrates and Nitroglycerin

Relative contraindication: Hypertrophic obstructive cardiomyopathy. Nitroglycerin should be avoided in patients with severe aortic valve stenosis. Coadministration of nitrates and sildenafil increases the risk of potentially life-threatening hypotension. There are potentially serious consequences of taking sildenafil within the 24-hour interval after taking a nitrate preparation, including sublingual nitroglycerin.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the physician and patient in light of all of the circumstances presented by that patient. There are circumstances where deviations from these guidelines are appropriate.
- The guideline developer reviewed the evidence of studies using electron-beam computed tomography (EBCT) for the detection and quantification of coronary

artery calcification and concluded that the proper role of EBCT is controversial and is the subject of the American College of Cardiology (ACC)/American Heart Association (AHA) Expert Consensus Document on Electron-Beam Computed Tomography for the Diagnosis and Prognosis of Coronary Artery Disease.

- Since some patients with ischemic heart disease may become asymptomatic with appropriate therapy, follow-up sections of the guideline may apply to patients who were previously symptomatic, including those with previous percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). The diagnosis, risk stratification, and treatment sections of these guidelines are intended to apply to symptomatic patients. Where appropriate, separate subsections consider the approach to the special group of asymptomatic patients with known or suspected coronary artery disease (CAD) on the basis of a history and/or electrocardiographic (ECG) evidence of previous myocardial infarction (MI), coronary angiography, or an abnormal noninvasive test. The inclusion of asymptomatic patients with abnormal noninvasive tests does not constitute an endorsement of such tests for the purposes of screening but simply acknowledges the clinical reality that such patients often present for evaluation after such tests have been performed.
- Multiple American College of Cardiology (ACC)/American Heart Association (AHA) guidelines and scientific statements have discouraged the use of ambulatory monitoring, treadmill testing, stress echocardiography, stress myocardial perfusion imaging, and electron-beam computed tomography (EBCT), previously called ultrafast computed tomography, as routine screening tests in asymptomatic individuals. The reader is referred to these documents (see Table 1 of the original guideline document) for a detailed discussion of screening, which is beyond the scope of these guidelines.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Clinical Algorithm
Pocket Guide/Reference Cards

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American College of Cardiology Foundation, American Heart Association. ACC/AHA 2002 guideline update for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to update the 1999 guidelines). Bethesda (MD): American College of Cardiology Foundation; 2002. 127 p. [1052 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999 Jun (revised 2002)

GUIDELINE DEVELOPER(S)

American College of Cardiology Foundation - Medical Specialty Society
American Heart Association - Professional Association

SOURCE(S) OF FUNDING

The American College of Cardiology Foundation and the American Heart Association. No outside funding accepted.

GUIDELINE COMMITTEE

Committee to Update the 1999 Guidelines for the Management of Patients With Chronic Stable Angina

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Committee Members: Raymond J. Gibbons, MD, FACC, FAHA (Chair); Jonathan Abrams, MD, FACC, FAHA; Kanu Chatterjee, MB, FACC; Jennifer Daley, MD, FACP; Prakash C. Deedwania, MD, FACC, FAHA; John S. Douglas, MD, FACC; T. Bruce Ferguson, Jr., MD; Stephan D. Fihn, MD, MPH, FACP; Theodore D. Fraker, Jr., MD, FACC; Julius M. Gardin, MD, FACC, FAHA; Robert A. O'Rourke, MD, FACC, FAHA; Richard C. Pasternak, MD, FACC, FAHA; Sankey V. Williams, MD, MACP

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Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The American College of Cardiology/American Heart Association (ACC/AHA) Task Force on Practice Guidelines makes every effort to avoid any actual or potential conflicts of interest that might arise as a result of an outside relationship or personal interest of a member of the writing panel. Specifically, all members of the writing panel are asked to provide disclosure statements of all such relationships that might be perceived as real or potential conflicts of interest. These statements are reviewed by the parent task force, reported orally to all members of the writing panel at the first meeting, and updated yearly and as changes occur.

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Gibbons RJ, Chatterjee K, Daley J, Douglas JS, Fihn SD, Gardin JM, Grunwald MA, Levy D, Lytle BW, O'Rourke RA, Schafer WP, Williams SV, Ritchie JL, Cheitlin MD, Eagle KA, Gardner TJ, Garson A Jr, Russell RO, Ryan TJ, Smith SC Jr. ACC/AHA/ACP-ASIM guidelines for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Patients With Chronic Stable). J Am Coll Cardiol 1999 Jun;33(7):2092-197.

GUIDELINE AVAILABILITY

Electronic copies: Available in from the American College of Cardiology (ACC) Web site and in Portable Document Format (PDF) from the American Heart Association (AHA) Web site.

Print copies: Single copies available from the American College of Cardiology, Resource Center, 9111 Old Georgetown Rd., Bethesda, MD 20814-1699; (800) 253-4636 (US only). Bulk reprints available from AHA, Public Information, 7272 Greenville Ave., Dallas TX 75231-4596; Reprint No. 71-0243.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

* Gibbons RJ, Abrams J, Chatterjee K, et al. ACC/AHA 2002 guideline update for the management of patients with chronic stable angina--summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on the Management of Patients With Chronic Stable Angina). Circulation 2003 Jan 7;107(1):149-58.

Electronic copies: Available in Portable Document Format (PDF) from the American College of Cardiology (ACC) Web site and the American Heart Association (AHA) Web site.

Print copies: Single copies available from the American College of Cardiology, Resource Center, 9111 Old Georgetown Rd., Bethesda, MD 20814-1699; (800) 253-4636 (US only). Bulk reprints available from AHA, Public Information, 7272 Greenville Ave., Dallas TX 75231-4596; Reprint No. 71-0244.

Also avaialable:

- ACC/AHA pocket guidelines for the management of patients with chronic stable angina.

Electronic copies available from the ACC Web site: Pocket Guideline and Personal Digital Assistant (PDA) version are available.

Print copies available from the ACC, Resource Center, 9111 Old Georgetown Rd., Bethesda, MD 20814-1699; (800) 253-4636 (US only).

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on December 29, 1999. The information was verified by the guideline developer on April 17, 2000. This summary was updated by ECRI on March 31, 2003. The information was verified by the guideline developer on June 16, 2003.

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Date Modified: 4/25/2005

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